PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT	:	GORDON, John, et al.
SERIAL NO	:	10/544,268
FILED	:	July 24, 2006
TITLE	:	WET/DRY SUIT WITH KNITTED WOOL LAYERS
Grp./A.U.	:	3675
Examiner	:	MUROMOTO JR, ROBERT H.
Conf. No.	:	1331
Docket No.	:	P07285US00

RULE 132 DECLARATION OF JOHN GORDON

1. I, John Gordon of 11 Westfield Close, Calderstones Park, Whalley, BB7 9XG, United Kingdom, confirm that I am one of the named inventors for the above application. The other named inventor is my son.

2. The subject matter of the invention is a particular configuration of the layers of material which, in conjunction, form a wetsuit or drysuit to be worn by a person when diving in a body of water and/or taking part in a water sport activity in or on a body of water.

3. I have 39 years experience in relation to using and manufacturing wetsuits and drysuits. I set up my own company, "Neptune Aquasuits" in New Zealand in 1969 for the purpose of manufacturing wetsuits and drysuits. I registered the company as a limited company in New Zealand in 1972.

4. Conventionally, wetsuits and drysuits have been manufactured with an outer layer of a foam material such as neoprene and it was known to provide an inner layer which was provided to lie between the outer layer and the wearer's skin. The outer layer was provided to form a thermal benefit to the wearer and the inner layer was provided for the purpose of easing the donning and doffing of the suit and also to enhance the strength of the suit.

5. In wetsuits, the basic structure of the same is such as to allow water to enter in a controlled manner, so that the water can provide thermal benefit to the wearer in conjunction with the air trapped in the outer layer. The water is not permitted to move to the extremities of the wetsuit as, if this occurred, a large percentage of the retained diver

heat energy would be lost. This control is typically achieved by the provision of relatively snug fitting cuffs in the wrist and ankles and a snug collar or attached hood around the neck or head. In a drysuit, water is not permitted to enter the interior of the suit. Conventionally, in both the drysuit and the wetsuit, the outer layer, being formed with closed cells, traps air or gas therein and is used to provide thermal protection and benefit to the wearer.

6. In all my years of experience it has always been the outer layer of foam material which has been used, adapted and configured to provide the required thermal benefit to the wearer in various designs of wetsuit and drysuit of which I have been aware. From my experience of use of these forms of suit I became aware that when diving, the water pressure increases on the suit and hence the foam outer layer. This increase in pressure acts to crush the closed cells in the outer layer material, so reducing the volume of trapped air therein and, as a direct result, this depletes the thermal protection offered by the suit as the wearer descends. This is particularly problematic as when the diver goes deeper in the body of water, so the temperature of the water decreases and so, as the wearer's need for thermal protection increases, so the thermal protection provided by the conventional suit actually decreases.

7. For example, as the diver descends, the thermal barrier offered by the compressible outer layer is severely reduced in a depth of the water by approximately 50% for every 33 feet of depth. So, whilst on, or adjacent to the surface of the body of water, the thermal advantage offered by the compressible outer layer of the conventional suit may be satisfactory, this soon deteriorates to an unacceptable level as the diver descends.

8. I, and my son, had therefore long felt that many wetsuits or drysuits were not designed to be fit for purpose and that they had not been designed by, or for, persons who use the suits for their intended purpose at depths in a body of water, or for a person who would use the same frequently. We therefore decided to provide an improved wetsuit and drysuit design which would allow the thermal benefit provided to the wearer to be maintained as the wearer descends in a body of water.

9 As a result of this work, we identified that, rather than trying to improve the thermal characteristics of the outer layer, or to provide additional insulating layers as was

conventionally the focus of attention with regard to thermal characteristics, the inner layer could be used as a thermal barrier for the wearer. Thus I have detailed in the application an invention to improve the thermal protection offered to a wearer which is achieved by providing the suit with an inner layer which is not just formed of any arbitrary combination of materials as would conventionally be the case, but to provide the inner layer formed within specific parameters which thereby allow the inner layer to provide a thermal barrier and hence allow the thermal benefits and protection of the suit of the current invention to be maintained in increasing depths of water, and hence be significantly more beneficial to the wearer than conventional suits. Thus, as set out in the above application, I have identified that it is not merely a matter of providing an inner layer attached to an outer layer but it is a matter of providing an inner layer which is substantially non compressible, thereby allowing the thermal benefits of the inner layer to be substantially maintained, regardless of the particular depth of water in which the suit is being worn at that instant.

10. I have identified that the use of an inner layer which is laminated to the outer layer and which is provided so as to retain the water in the inner layer rather than allow the same to flow into the outer layer and which contains wool and is of a weight in the region of 50 - 500 grams per square meter provides an inner layer which is substantially non compressible at depth when filled with water in the case of the wetsuit, or perspiration from the wearer in the case of the drysuit. It is found that the thermal protection and benefit provided by the inner layer in these parameters is, at the surface of the water, largely the same as provided to the user when the wearer is in a greater depth of water, such as for example, at depths below 33 feet. Thus even at this depth, any thermal benefit from the outer layer is greatly reduced as the outer layer is compressed and therefore the wearer becomes increasingly reliant upon the non-compressed inner layer and the improved thermal advantage offered by the non compressible wool/retained liquid water layer becomes very significant.

11. I have identified that the use of wool in the manner defined in the claims of the application in the inner layer in the particular form as now described in the claims of my application rather than the use of wool or any other of the materials suggested as possible

options in all of the prior art documents is critical. This is because the wool has a combination of Hygroscopic and Hydrophilic characteristics that makes it such an effective thermal barrier when used with the parameters as now set out. On wetting with water or perspiration the wool fibers are initially hygroscopic, hence absorbing the water and then locking this water into the hollow wool fiber to retain the same in the inner layer. Upon saturation being reached, the outer scales on the wool fibers close to lock in the water, hence swelling and retaining the water into the inner layer of the suit to resist compression of the same and the fibers at this point become hydrophilic. All other linings formed of synthetic materials or non specific blends cannot swell and retain the water and therefore offer a relatively small thermal barrier.

12. Another advantage of the process of "wetting" the wool is the exothermic reaction that occurs in wool during the wetting process. Heat is released through a chemical reaction resulting from the "binding" of water to the keratin that is naturally inherent within the wool fibers. This process is known as "heat of sorption" and releases a measurable amount of heat directly into the non-compressible liquid saturated wool containing inner layer, further enhancing the thermal benefit to the wearer.

13. A further advantage of the non-compressible liquid saturated wool containing inner layer as set out in the claims of the application is that it acts as a very efficient heat sink. This means that the inner layer initially absorbs heat energy from the surface of the divers skin during the periods of high activity by the diver. This energy is retained and returned to the diver during periods of lower activity, such as, for example, towards the end of a dive.

14. In certain instances synthetic yarn can be added to the wool to form the inner layer within the parameters set out in the claims of the application in order to provide specific strength and/or elasticity characteristics without unduly affecting the thermal advantages of the wool.

15. With regard to my patent application, I, as the named inventor, have become familiar with the office actions which have been issued by the Patent Office in this case and particularly the final office action of November 19, 2008. I have also familiarized myself with the Pogorski reference US Patent 4274158. To my knowledge, no product has ever been manufactured commercially in line with the Pogorski patent. I am unaware of any

commercial product of the type described therein. It is my view that the Pogorski patent does not meet or disclose the specific limits and parameters of the set of claims of my application as now submitted and, although it does disclose the possibility of using wool, or equally other synthetic materials to form an inner layer it particularly fails to disclose the current invention in the following respects.

16. The Pogorski patent suggests that the provision of the inner and outer layers are an optional provision which suggests to me that Pogorski had no knowledge that this would have any effect on the thermal performance of the suit. In my product the inner layer with the wool including within the specific parameters is the effective thermal barrier of the suit and, if not provided, would greatly affect the usability of the same.

17. The column 5, lines 33-35 of the Pogorski patent suggest that the inner layer can be made of knitted nylon and then in lines 42-44 suggest that cotton or wool fiber could be used as alternatives. It should be clear that nylon or cotton are not alternatives for wool for an inner layer in accordance with the claims of my invention as they would not perform the same function. Furthermore there is no suggestion in Pogorski of any specific weight of the inner layer and certainly not of the specific weight range of the wool containing inner layer in accordance with my invention of 50-500 grammes per square meter in order to allow the thermal characteristics of my invention to be achieved by allowing the retention of the liquid within the inner layer.

18 While the Pogorski patent suggests that the inner layer may absorb perspiration in a drysuit and limit movement of water between the wearer and the suit in a wetsuit these features are quite clearly regarded as being possible by Pogorski patent whether the inner layer is formed of nylon, cotton or wool fibers. There is no suggestion in the Pogorski patent that the inner layer must be non-compressible in order to provide a thermal barrier and indeed this non –compressibility would not be achievable using the materials and information provided. In contrast, in my invention by providing the inner layer including wool and at a weight of between 50-500 grammes per square meter, so I have been able to provide for the retention of the liquid within the inner layer in order to form the substantially incompressible thermal barrier which provides significant benefit to the wearer and which is not disclosed as possible in the Pogorski patent. I have also identified

that a proportion of synthetic material can be added to the inner layer in order to further strengthen the inner layer in use, whilst at the same time identifying the proportion limits so as to ensure that the provision of the non-compressible thermal barrier can be achieved.

19. Wetsuits and Drysuits manufactured in accordance with the application and containing inner layers as specific in the application are now sold by my company and agents under the Merino Registered Trade Mark and have been for the last six years.

20. The wetsuits and drysuits manufactured in accordance with this application and granted patents in other countries have been sold and are in use across the world including the countries listed below and licenses and distribution agreements are in place with several third parties: Argentina; Australia; Bahamas; Brazil; Canada; China; Costa Rica; Croatia; Denmark; Dominican Republic; Fiji; Finland; France; Germany; Greece; Honduras; Hong Kong; Ireland; Israel; Italy; Japan; Lithuania; Latvia; Luxemburg; Mexico; Netherlands; New Zealand; Norway; Philippines; Poland; Portugal; Russia; Saipan; Singapore; South Africa; South Korea; Sweden; Thailand; Turkey; Ukraine; UK; USA; and West Indies.

21. Testimonials received from purchasers and users of wetsuits in accordance with the application have been received and are enclosed in Appendix 1, and it will be seen that these all support the significance and inventive merit of providing the wool containing inner layer in the manner set out in the application.

22. The products has also been extensively tested and one set of test results are enclosed in Appendix 2. The test results are from an independent test laboratory, the A.G. Bau test laboratory in Germany who are an approved test laboratory for thermal testing of neoprene for wetsuits and drysuits for the European CEN directives that all wetsuits and drysuits must now be tested to.

23. The test was undertaken on various products, including our own product (the first three entries) in which wool was used to form the inner layer which was laminated to the outer layer of Neoprene. The weight of the wool inner layer was within the range of 50-500 grammes per square meter. The tests were performed to test the thermal barrier offered by our products in accordance with the wording of the claims of the patent application in respect to various commercially available conventional combinations of products having

linings and thicknesses of products with an outer layer of neoprene foam. If one considers the right hand column of the test table, Grade A is the highest, most thermally efficient result. Tests were undertaken at the surface of a body of water and under a pressure equivalent to a depth in water of 50 meters and the data processed to arrive at the thermal efficiency value and then the samples were graded into the 4 thermal categories of "A"; "B"; "C"; and "D". The inner layers tested comprised of a wool containing layer in varying thicknesses with a weight in the range of 50-500 grammes per square meter in each case in accordance with the invention of the patent application and in this case Merino wool was used as referred to in column 2. The samples of the conventional products comprised sample LT110-1 which is a "plush" lining which attempts to mimic wool by using a thick pile lining formed of synthetic material, NF-01 which is a "plush" lining similar to LT110-1 but not as thick and N246 which is a standard nylon inner layer. It will be clearly seen by referring to the Thermal Class column that our product incorporating the inner layer as set out in the current invention achieves the "A" category which is not achieved by any of the other inner layer materials of similar thicknesses.

The undersigned further declares that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application of any patent issuing thereon.

Date 6. JANUARY 2009

JOHN GORDON

Appendix 1

September 2004 DIVER MAGAZINE DIVER

Article written by that unbiased, tells it as it is ..... John Bantin

Woolly wetsuit for British divers.

During the **middle ages,** Merino wool was so prized that it was made illegal, on pain of death, to export a Merino sheep from Spain, lest it break the kingdom's dominance of the wool trade. The intensive grazing of Merino sheep stocks in those years gave Spain the stark landscape it has today.

Nowadays the finest Merino flocks are to be found in New Zealand, where a pristine Alpine landscape of the sort you saw in Lord of the Rings results in an elite type of sheep – and the Spanish are still complaining about it!

We all know about the efficacy of wool for keeping you warm. Merino wool has particularly fine fibres and its complex natural structure, with its hydrophobic outer scales and hydrophilic inner cells, keeps both the sheep and those wearing garments made from their wool extremely warm and dry.

New Zealand Merino sheep are said to have a fleece with extra-long hollow fibres, resulting in a particularly soft and strong end product.

What does this all have to do with diving? John Gordon, doyen of diving suit designers, has a son who lives in New Zealand. Ever thinking of ways to improve his design's thermal efficiency, he tried Merino wool as a suit-lining and found that it out-performed in many ways the more often used synthetic materials made from petro-chemical products.

Waterlogged Layer

Water is the insulator in a wetsuit. The Pinnacle Polar has a Merino wool lining that absorbs and retains water entering the suit. This creates a waterlogged layer between your skin and the suit which can add up to 3mm of extra insulation. On top of that, the wool is exothermic, in that it produces heat as it gets wet.

The Pinnacle Polar is a one-piece suit made with a mix of 5mm and 7mm neoprene. It has a front-entry cross-chest zip. Long zips at the ankles allow the neoprene outer layer to cover

soft latex seals but let a big foot like mine pass through. The seals deter water from flushing through.

The cuffs of the sleeves have O-ring-type seals at the ends and a chimney seal in the sleeve for the same reason. Underneath the main zip is a soft 3mm shoulder cape that you wriggle into place once the suit is pulled up to the chest. Then, with the hood pulled up over the head from behind, the main zip is closed.

There is a knack to this. This suit is cut with pre-bent arms and legs, and gussets on the inner curve of the elbows and knees allow for a degree of mobility otherwise denied. Hood up and zipped in, like a medieval knight at a jousting tournament, I felt well-insulated from the outside world.

Let's be clear – this suit does not have a fluffy or towelling like lining, because the Merino wool is knitted into a tough cloth. Nor is the Pinnacle Polar a drysuit. Although it has internal seals within the arms and soft latex seals at the ankles to prevent flushing, it needs some water within it to be fully thermally efficient, as with any wetsuit.

The knit of the Merino lining helps to reduce the movement of the water inside the suit, and because the insulating layer of this wetsuit is water, it is incompressible and unaffected by depth.

So although the neoprene of the outer layer crushes and loses its insulating properties (it can half its thickness between the surface and 40m) as all neoprene does, the 3mm of water held in the lining between you and the suit's outer layer does not.

I am told that in tests carried out by the British Textile Technology group, Merino wool offered a serious increase in thermal efficiency over synthetic linings.

So are there any disadvantages to having a soggy lining to your wetsuit? It doesn't feel itchy against the skin because the wool is so fine, and because of its ability to draw water away from its surface, it doesn't really feel soggy at all.

It's claimed that the uneven surface structure helps to prevent the build-up of odour-causing bacteria, and the natural crimp seems to make it resilient to Velcro-attack too. So, no disadvantage as far as I could tell.

In fact I was so well protected from the cold that I felt ready to jump into an ice-cold flooded quarry if needs be. But I didn't.

It was a pity that the suit which had been specially tailored to fit me was such a close fit. I needed a lot of time to squeeze myself into it, and once the hood was pulled over, I felt I was clammed shut.

I suddenly realised why traditional divers carried that big brass-handled Siebe-Gorman knife. I though that, had I needed to get out in a hurry, the boys from the fire-brigade would have used something similar!

This is no criticism of the suits, simply an observation that personal tailoring is not without its problems. I asked the importer to send me a larger off-the-peg size in which to go diving.

The Red Sea in early June might be expected to be warm, and some of my fellow-divers had arrived with nothing more that dive-skins. It was 24° C. I have never been too warm on a dive but I have often been too cold, especially as time passes.

In the Pinnacle Polar, I was snug as a bug, and because the zip is positioned across the front, I needed no help getting in and out of it. I got a bit of a grief from the boat captain for taking 75 minutes over a dive while the others were coming back well within the hour, but he was confusing me with someone who was not relishing the comfort of his suit.

I have to say that it proved to be one of the most comfortable and effective suits I have ever used: almost as warm as a drysuit but as unencumbering as a wetsuit.

The only downside was the extra lead I appeared to need to carry to counteract its natural buoyancy.

That said I have decided to retain the suit a little longer for "extra testing". Just one other point for those who worry about such matters – wool is a renewable resource.

... straight down the line

PLUS
+A semi-dry for the coldest conditions

MINUS
-Dry Suit Divers won't belive it

From: "Melanie Price"
Date: Tue, 20 Jan 2009 12:24:27 -0600
To: <greg@g2scuba.com>
Subject: RE: Merino Testimonials

Greg,

As a dive shop owner for both recreational and commercial divers. It is important that I can supply quality performance wetsuits all under one brand.

Because of the great response from our customers and personal experience with the Merino Wetsuit. We have decided to stock only Pinnacle wetsuits.

Our Commercial Division has very hard core, deep water divers. These divers are in the water working on pipelines, rigs and Ships for many hours at a time.

It only took one Commercial Diver to tell a friend about how warm he was in the cold Gulf Waters. It spread like wild fire.

The Merino Wool is like a Miracle blanket for these wetsuits.

I have heard nothing but positive feed back from our divers. There is no other fit, comfort and warmth out there. Thanks so much for introducing us to the Pinnacle line. It is our Wetsuit of choice.

Warmest Regards.

Melanie Price.

Regards,
Melanie Price

907 Chateau Woods Pkwy. #905
Conroe, Texas 77385
(near The Woodlands)

281-363-3764 office
281-292-3267 fax

www.KickadyScuba.com
Boy Scouts; also Alternative PE for CISD w/ credits

www.KickadyDeepSea.com – Commercial Info. - Commercial Dept. Provides training and equipment
For Police and Fire Dept. Dive Teams, Inland/Offshore Divers.

From: scuba329@comcast.net
To: Matt Mulryan
Sent: Jan 20, 2009 3:57 PM
Subject: Pinnacle Products

Hi Matt, just wanted to let you know how pleased I am with the evolution 2 dry suit. The undergarment I have is the Merino-Evolution, this is by far the warmest undergarment I have ever used. This is the fourth Dry suit I have owned and far surpasses anything else i have used. One of our Instructors is ordering the Merino undergarment for his suit after trying mine.

Also just a short note, that Dave Zarling President of a local dive club purchased the 7mm Merino lined hood from us and states that it is the warmest hood he has ever owned, and that it helped extend his diving season year round.

Thank You,
Don Wrona
Owner Anchor Bay Scuba-Fairhaven Michigan PADI Master Inst. #1272

Appendix 2

THERMAL TESTING NEOPRENES AND LININGS TO CE 14225:1 WETSUITS
DATE: 6 March 2007

LININGS		Neoprene foam type	THICKNESS		Size sample mm	Number Of samples	Sample code	Sample description	Thermal class
External	Internal		Nominal neoprene mm	Actual neoprene mm					
N246	Merino PMTL	FO4	7	7.5	420 x 300	2	PNM-001	N/FO4/PMTL-7mm	A
N246	Merino PMTL	SS-1	7	7.5	420 x 300	2	PNM-003	N/SS1/PMTL-7mm	A
N246	Merino PMTL	SS-1	6	6.5	420 x 300	2	PNM-005A	N/SS1/PMTL-5mm	A
N246	LT 110-1 Charcoal	FO4	7	7.5	420 x 300	2	SOL-007	N/FO4/LT110-7mm	B
N246	LT 110-1 Charcoal	SS-1	7	7.3	420 x 300	2	SOL-008	N/SS1/LT110-7mm	B
N246	LT 110-1 Charcoal	FO4	5	5.2	420 x 300	2	SOL-009	N/FO4/LT110-5mm	B
N246	NF-01 Black	SS-1	7	7.3	420 x 300	2	OCE-013	N/SS1/NF01-7mm	B
N246	N246 Black	FO4	7	7.5	420 x 300	2	OCE-014	N/FO4/N- 7mm	B
N246	N246 Black	FO4	5	5.5	420 x 300	2	SOL-015	N/FO4/N- 5mm	C